29. The External Characters of the Pigmy Hippopotamus (*Chœropsis liberiensis*) and of the Suidæ and Camelidæ.

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(Text-figures 30 to 46.)

Contents.

The fresh material upon which the observations contained in this paper are based was examined in the Society's Prosectorium immediately after the death of the specimens. In the case of some of the Suidæ, like *Porcula* and *Hylochœrus*, I have been compelled to rely upon dried skins in the British Museum.

The only rare species examined was the Pigmy Hippopotamus, of which a single old male example, presented by the Duke of Bedford on December 16, 1913, died February 11, 1919.

Section SUINA.

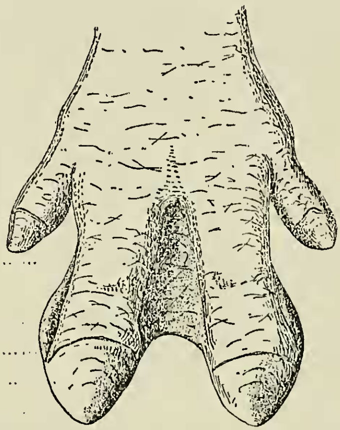
Family Hippopotamidæ.

Chœropsis liberiensis.

Owing to its smaller head, much shorter body, and relatively longer legs, the Pigmy Hippopotamus differs markedly in external appearance from its larger ally. It was generically separated from the latter, owing to the loss of a pair of incisor teeth in the lower jaw.

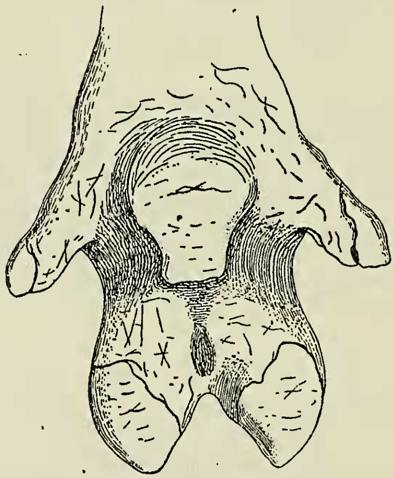
The *muzzle* is provided with short scattered bristles, but, apart

Text-figure 30.



Hind foot of *Chœropsis liberiensis* from above.

Text-figure 31.



The same from below.

from these, the facial vibrissæ characteristic of the normal terrestrial mammalia appear to be unrepresented. The nostrils are widely separated, oblique, valvular slits, capable of being tightly closed, and look forwards and upwards from the summit of the muzzle. There is no differentiated rhinarium.

The *ears* are small, simple, and, like the nostrils, capable of being tightly closed. The hollow of the outer side is furnished with three soft, ridge-like thickenings which, when the ear is folded, are pressed together so as to block the orifice. (Text-fig. 33, A.)

Text-figure 32.

A. Right fore foot of *Chœropsis liberiensis* from below.
B & C. The same foot from the outer and inner sides.

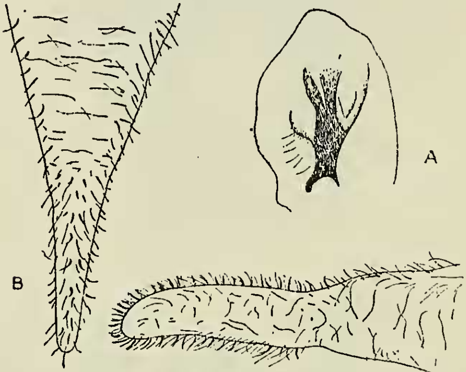
The *feet* are of the most primitive type found in the Artiodactyla. They are symmetrical or nearly so; the tips of the four toes rest on the ground, and with the help of a well-developed plantar pad support the weight of the animal when walking or standing.

The two main digits, morphologically the third and fourth, are united for the greater part of their length by integument, but they are not tightly and compactly welded together. The depression between them on the upper side is tolerably deep; they can be separated to a considerable extent, and their distal ends carrying the hoofs are free. The hoofs are small and bluntly pointed, and there is no clear line of demarcation laterally between their edges and the area of flat horny integument constituting the sole of the toe.

The lateral digits are much smaller, are free from webbing, and the small hoofs encircle their tips.

The sole of the foot is covered with naked wrinkled skin. On the area between the plantar pad and the edge of the webbing uniting the two larger digits there is a shallow depression which may be glandular, but I was unable to investigate its nature by sections. The plantar pad is irregularly heart-shaped, being narrow and more or less truncated in front, where it stands up as

Text-figure 33.



A. Ear of *Chœropsis liberiensis.*
B & C. Dorsal and lateral views of the tail of the same.

a well-defined horny cushion, and widely rounded behind, where it is ill-defined and gradually blends with the integument above or behind it. (Text-figs. 30–32.)

There is no marked difference in size or structure between the fore and hind foot, except that in the latter the two smaller digits are alike in size, whereas in the former the outer digit is considerably thicker and larger than the inner. This is the only particular in which there is distinct asymmetry in the feet.

The feet of living examples of *Hippopotamus amphibius* that I have seen differ from those of *Chœropsis liberiensis* in being much more compactly built. There is no great difference in size between the four digits, and since they are much more closely united by integument, the feet are incapable of the expansion observable in *Chœropsis.* In the greater freedom of the digits the latter genus stands nearer to the Suidæ *.

The *tail* is short. Its base is broad with convex edges, but its distal half is thin, parallel-sided, strongly compressed, and provided with stiff short bristles. It serves apparently merely as a cover to the anus, and in the female of the genital orifice as well. (Text-fig. 33, B, C.)

The *penis* is quite simple, cylindrical for the greater part of its length, and somewhat abruptly attenuated at the apex, the orifice being terminal. The penis is like that of *Sus scrofa*, but has no spiral twist when retracted.

Family Suidæ.

The Rhinarium.

The general character of the rhinarium in the Suidæ is well known. It is a movable disk, the upper and lateral edges of which project to a greater or less extent beyond the skin of the muzzle. Its anterior moist surface is nearly flat, its upper portion being nearly naked, and the lower covered with short, stiff, sparse hairs. The area below the nostrils is usually wider than the area above them, and the edges are, generally speaking, convex, although the lower is less curved than the upper. The nostrils look straight forwards, and are set on each side of the middle line of the disk some distance apart. They do not extend to its lateral edge, the lateral narial slit being absent or so short as to be practically negligible. Their inner and upper edges are sharply defined, but the outer blends gradually with the adjacent surface of the rhinarium.

In most of the genera of the family—*Sus*, *Potamochœrus*, and *Dicotyles*† (*Tayassu* and *Pecari*)—the variation in shape and structure is comparatively slight, and the differences shown in the sketches may be individual and not specific or generic. In all these cases the median height is less than the greatest width by about one-fourth or less, and the sides from the widest points a little below the nostrils are inclined inwards and upwards in a nearly straight line to the curved summit, and the distance between the nostrils is more than one-third but less than one-half the median height.

In an example of *Sus scrofa* the widest part is just below the inferior edge of the nostrils, and the infero-lateral margin is rather markedly convex, and the sides from the level of the

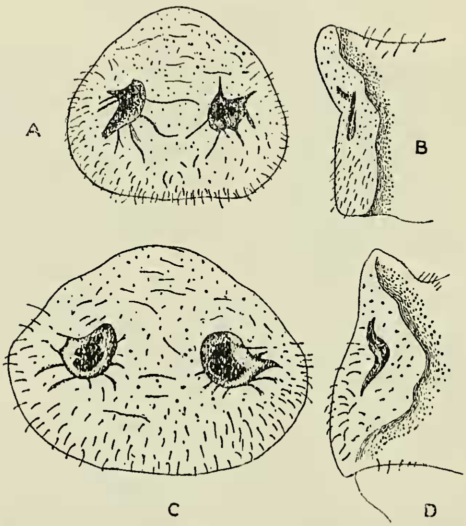
* In the mounted specimen of *Hippopotamus amphibius* in the Natural History Museum, the characters of the feet here mentioned are not so apparent. The approximate equality between the four digits is seen, but there is a deep depression between the second and third, making the feet look more like those of *Chœropsis.* This, however, is probably due to the shrinkage of the interdigital tissue with drying.

† For convenience I retain in this paper the old familiar name *Dicotyles* for the American Suidæ.

nostrils slope upwards and inwards with a slightly sinuous curve to the narrowed, rounded summit. In *S. leucomystax* the greatest width is about midway between the nostrils and the lower edge, which is straighter than in *S. scrofa*, and the height, as compared with the width, is considerably greater than in the latter. (Text-fig. 34.)

In *Potamochœrus porcus* the upper edge is much more widely rounded than in the two species of *Sus*, and the infero-lateral margins at the widest part of the rhinarium below the level of the nostrils is not so widely rounded, the edge from that point inclining inwards and upwards, being very lightly concave. (Text-fig. 35, B.)

Text-figure 34.



A, B. Front and side views of rhinarium of *Sus leucomystax*.
C, D. The same of *Sus scrofa*.

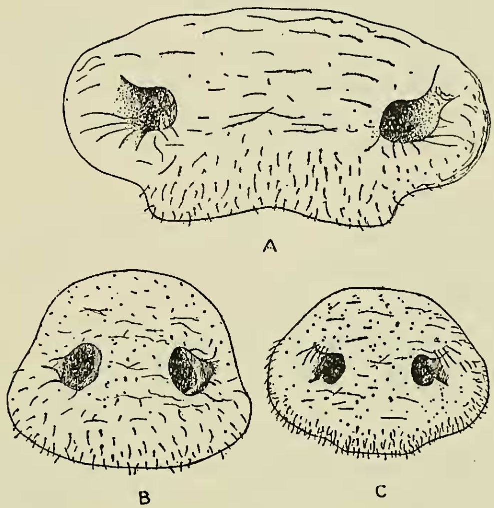
In two species of Peccary, the collared (*D. tajacu=torquatus*) and white-lipped (*D. pecari=labiatus*), the rhinarium is as wide on a level with the upper edge of the nostril as below that point, which is not the case in *Sus* or *Potamochœrus*. (Text-fig. 35, C.)

In *Phacochœrus* the rhinarium differs from that of the genera described above in several particulars. It is about twice as wide as high, has a lightly convex upper edge, the lateral margins strongly convex round the nostrils, and sinuously concave below where they form a definite angle with the lower edge, which is lightly concave, especially in the middle line. (Text fig. 35 A.)

It is not possible to determine the exact shape of the rhinaria on dried skins; but so far as I can judge from material in the Natural History Museum, the rhinarium of *Hylochœrus* is relatively much larger than in *Potamochœrus*, and approaches in relative width that of *Phacochœrus*.

Porcula, as might be expected, appears to resemble *Sus* in the shape of this organ.

Text-figure 35.



A. Front view of rhinarium of *Phacochœrus africanus*.
B. The same of *Potamochœrus porcus*.
C. The same of *Dicotyles pecari*.

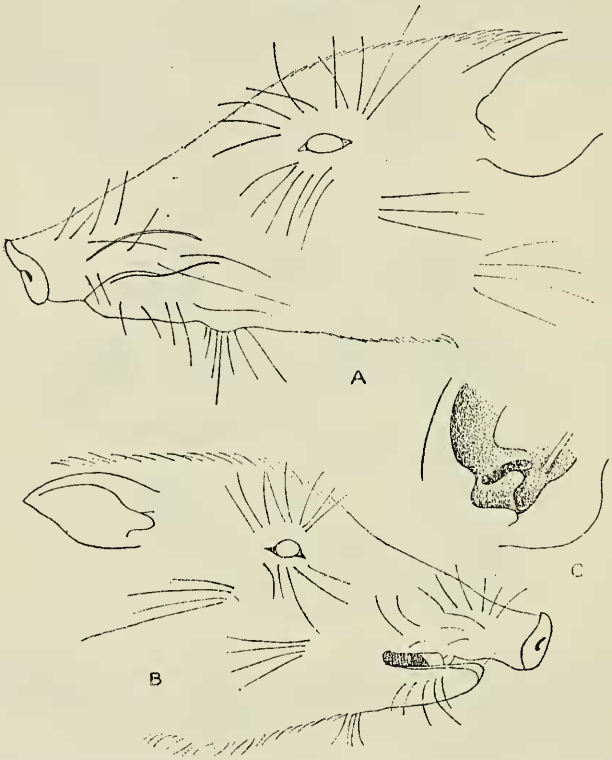
The following table of measurements in mm. will show the principal distinctive features of the rhinarium of *Phacochœrus* as compared with that of the other genera:—

	Height.	Width.	Distance between nostrils.
Sus scrofa	64	88	23
Sus leucomystax	55	63	18
Potamochœrus porcus	51	63	19
Dicotyles pecari (*labiatus*)	43	57	18
Phacochœrus africanus	52	112	53

The Facial Vibrissæ.

The full complement of facial vibrissæ characteristic of the Mammalia can sometimes be detected in the Suidæ, but I have failed frequently to trace the genal tufts, owing to their being either suppressed or indistinguishable in the thick clothing of coarse hair which generally covers the cheek. The mystacials

Text-figure 36.



A. Side view of head of *Potamochœrus porcus* showing facial vibrissæ.
B. The same of *Dicotyles pecari.*
C. Base of the ear of *P. porcus.*

are relatively short and scattered, and apparently of less importance than the others, probably on account of the prominence and sensitiveness of the specialized rhinarium. The lower lip is always provided with scattered submentals approximately as long as the mystacials; but the superciliaries and suboculars are always long and plentiful as if the protection of the eye was of importance. Typically the interramal tuft is composed of about half a dozen moderately long vibrissæ.

In the two species of Peccary (*D. tajacu* and *pecari*) I have found all the tufts developed as described above, and, in addition, the two genal tufts, the lower situated in a line with the slit of the mouth and beneath the anterior angle of the eye, the upper higher up and beneath and behind the posterior angle of the eye. (Text-fig. 36, B.)

In *Potamochœrus porcus* the ocular and interramal vibrissæ are well developed, and I detected two genal tufts, the upper situated as in *Dicotyles*, the lower set very far back beneath the base of the ear on the angle of the lower jaw. The upper tuft, however, was only distinguishable from the normal coarse hairs of the cheek by rising from a low integumental swelling, and the homology of the lower tuft with that of *Dicotyles* is rendered a little doubtful by its abnormally backward position. (Text-fig. 36, A.)

In dried skins of *Porcula salvania* the buccal, ocular, and interramal vibrissæ are normally developed, but the genals are indistinguishable.

In *Phacochœrus* the buccal and ocular vibrissæ alone seem to be constant. In one case I detected a few bristles set about one inch below the subocular wart, which I believe to represent the upper genal tuft; but I could find no trace of the lower genal tuft, unless a short row of black bristles beneath the white fringe on the cheek is to be referred to it. The interramal is represented at most by one or two long bristles.

In dried skins of *Hylochœrus* the buccal and ocular vibrissæ are as in *Phacochœrus*, but the genals are not traceable in the long hairs of the cheek. I may here add that the fringe of pale hair on the cheek in *Hylochœrus* seems to overlie an area of skin with special glandular activity.

The Ear.

Boas (Die Ohrknorpel . . . der Säugethiere, 1912) describes and figures the ears of *Sus scrofa* and *Dicotyles tajacu.* Each is provided with three supporting ridges, the anterior of which is curved backwards at the base, where it arches over a deep groove bounded below by an oblique thickening or ridge, which is itself defined by a deep groove from the basal thickening which descends to the auditory orifice. The anterior edge of the pinna is turned backwards in both genera, and the posterior edge as well in *Dicotyles.* At the base of the anterior edge there is a small excrescence.

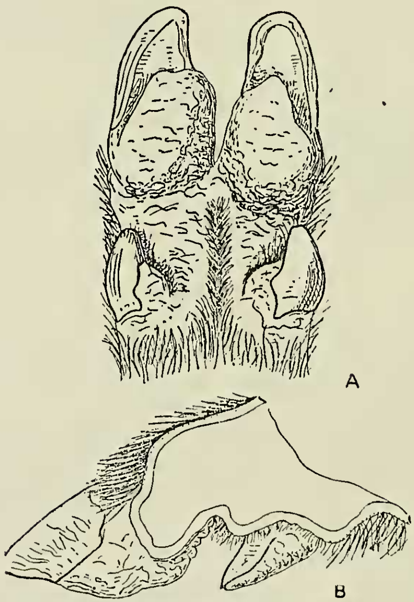
In *Potamochœrus porcus* the anterior edge is folded backwards at the base, but there are no definite tragal or antitragal thickenings. There is a feebly-developed anterior and posterior supporting ridge, and the former rises inferiorly close to the basal thickening, which is divided into an upper and a lower part by a deep groove or cleft. The part above this groove forms an abbreviated longitudinal thickened ridge, well defined in front, but blending behind with the integument of the ear. It suggestively resembles the supratragus (*plica principalis*) of the ear of typical mammals, the retention of which in the Suidæ would be of interest, but Boas does not identify it with that ridge. The part below the groove descends into the tubular part of the ear, and is pierced inferiorly by the auditory orifice. Its upper edge, just beneath the supratragal ridge, is raised posteriorly into a rounded excrescence. (Text-fig. 36, C.)

The ears vary in size and shape according to the genera. In *Sus scrofa* and *Potamochœrus porcus* the posterior edge is lightly concave above and widely rounded below, the apex being more elongated in the latter than in the former genus. In *Phacochœrus* the posterior border is not widely rounded inferiorly, but is emarginate, and above the emargination there is an angular lappet.

The Feet.

The feet of the Suidæ differ from those of the Hippopotamidæ in that progression is bidigital, the weight of the body resting

Text-figure 37.

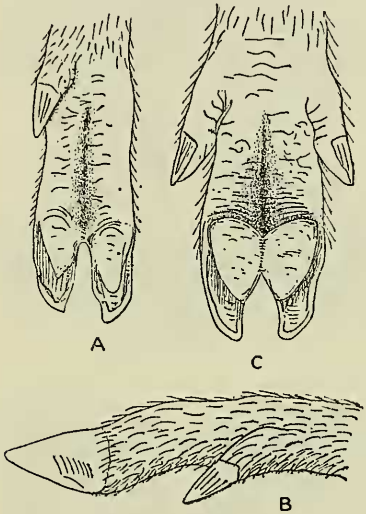


A. Lower view of foot of *Sus scrofa*.
B. Section of foot of the same.

upon the hoofs of the second and third digits, those of the first and fourth at most touching the ground with their tips. There is no median plantar pad, but the third and fourth digits are provided beneath with two horny pads behind the nail of the hoofs, constituting a pair of heels. The nails of these digits are narrowed apically, flattened on the inner side, and fit together like those of typical ruminant Artiodactyles.

Except for the well-known variation in the case of *Dicotyles*, where the fourth or outer digit of the hind foot is absent, the inner being retained and used for scratching, the feet of the different genera and species of Pigs are very much alike. The interdigital depression is shallow, sparsely hairy, and not glandular, and the back of the pasterns and fetlock to a point just above the lateral hoofs is usually naked, although in

Text-figure 38.



A. Lower view of left hind foot of *Dicotyles*.

B. The same from the side.

C. Lower view of foot of *Phacochœrus*, showing the fusion of the heels.

an example of *Sus scrofa* there was a median line of hair extending almost down to the heels. The foot of *Phacochœrus* differs, however, from that of *Dicotyles*, *Sus*, *Porcula*, and *Potamochœrus* in having the heels united; but the degree of fusion is, I think, variable, although in some cases it is very marked and practically complete. Judging from dried skins, *Hylochœrus* has separated heels like *Potamochœrus*. (Text-figs. 37, 38.)

I have found no specialized glands in the feet either of *Dicotyles* or *Phacochœrus*, and with regard to the incidence of the glands that have been recorded in other genera, further information is required before definite conclusions can be reached.

Those on the carpus of the common pig are well known, and are said to occur in both boars and sows. I figured and described them as seen in a wild boar, *Sus scrofa*, but I subsequently failed to find a trace of them in a sow of this species and also in a sow of the Japanese species, *Sus leucomystax*, and I similarly failed in the case of a boar of the Indian species, *Sus cristatus*.

I have had no opportunity of studying further the peculiar glands in the feet of the male of *Potamochœrus porcus*, which I described a few years ago (Proc. Zool. Soc. 1916, p. 747), and can add nothing to the original account.

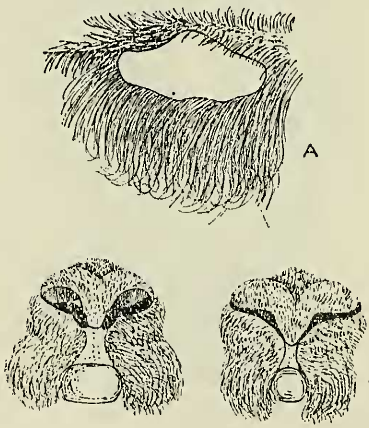
Section TYLOPODA.

Family Camelidæ*.

The Muzzle.

The facial vibrissæ in this family are so poorly developed as to be practically negligible.

Text-figure 39.



A. Metatarsal gland of the Alpaca (*Lama glama*).
B. Muzzle of *Lama huanacus* with the lips spread and the nostrils dilated.
C. The same of *L. vicugna* with the lips only partially spread and the nostrils nearly closed.

The muzzle has the upper lip completely cleft, the two halves being freely movable and separated by a philtrum of naked skin, which extends down to the premaxillary gum-pad against which

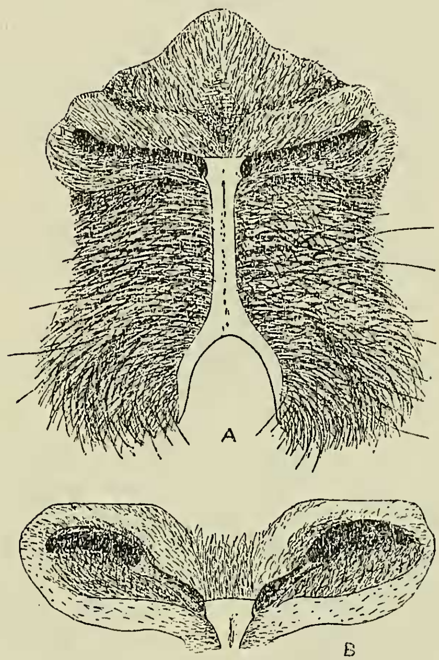
* In all the examples of *Lama* that I have dissected, and in the one example of *Camelus dromedarius*, I found the so-called "water-cells" of the rumen packed with food and not filled with water. They are no doubt primarily "food-cells," and secondarily become filled with water in *Camelus* when food is unobtainable.

the lower incisors bite. The two halves of the upper lip hang down on each side of this pad. The upper surface of the nose and the area all round the nostrils, which are elongated dilatable slits, are covered with fine short hairs.

In *Lama vicugna* and *huanacus** the internarial septum is hairy, and the philtrum is a short area about twice as long as wide when expanded. (Text-fig. 39, B, C.)

The muzzle of *Camelus dromedarius* closely resembles that of

Text-figure 40.



A. Muzzle of *Camelus dromedarius* with nostrils nearly closed.
B. Nostrils of the same dilated.

Lama, but is much deeper below the nostrils and has the philtrum very much longer. Inferiorly, moreover, the philtrum is continued on each side as a narrow strip along the inner edge of the lips, while it is slightly expanded above and abuts against the inner ends of the nostrils. The nostrils are long and valvular,

* In Lydekker's Catalogue of Ungulates, iv. p. 302, the Huanaco is cited as *Lama glama huanacus*, on the assumption that it is the wild form from which the domesticated Llama and Alpaca were derived. The differences between the wild and the tame animals are, however, too well marked to warrant the unqualified acceptance of that opinion. The Llama, indeed, may represent a species wholly reclaimed from the wild state.

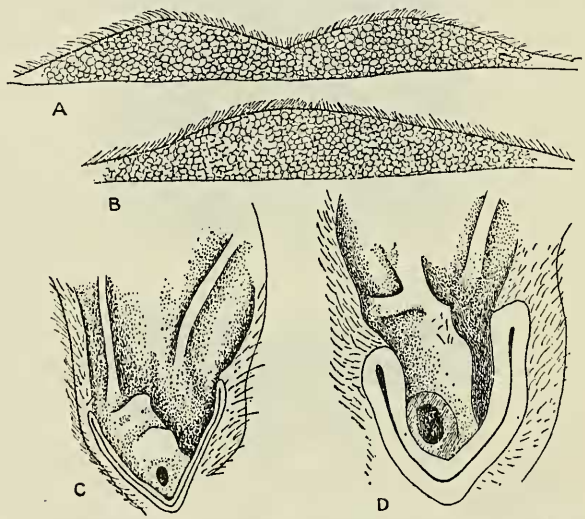
and are lined for some distance inside with short hair. (Text-fig. 40, A, B.)

The complete cleavage of the upper lip by a philtrum, and the mobility of its two halves inferiorly where they project below and on each side of the premaxillary gum-pad, are characters of the Tylopoda as remarkable as any that are usually cited as diagnostic of that section of Artiodactyla.

The Occipital Gland of Camelus.

In my paper on the Specialised cutaneous scent-glands of Ruminants (Proc. Zool. Soc. 1910, p. 973), I described the occipital gland of the two species of *Camelus* as observable on the living animals. I there stated that there are a pair of such glands. That was an error due to the interpretation of the gland by touch. There is a single gland, about as wide as long and

Text-figure 41.



A. Transverse section of the occipital gland of *Camelus dromedarius*.
B. Longitudinal section of the same.
C. Base of ear of *Lama vicugna*.
D. The same of *Camelus dromedarius*.

covered with hair. It is composed of thickened skin, which gradually thins out marginally where it runs into the normal skin at the back of the head. Its lower half is rather thicker than the upper, and in the middle there is a wide and tolerably deep longitudinal depression, and it was the resulting biconvexity of the gland which deceived me into thinking there were two. (Text-fig. 41, A, B.)

The Ears.

The ears of *Lama* are long, narrow, and pointed *. On their inner surface they are strengthened by two longitudinal ridges. The posterior of these is slightly oblique, and does not descend inferiorly into the posterior portion of the ear. The anterior is straighter, and inferiorly rises close to the basal thickening, which forms a rounded prominence. This thickening is pierced below by the auditory orifice. These ears are remarkably like those of the typical Ruminant Artiodactyla. (Text-fig. 41, C.)

The ear of *Camelus dromedarius* is much shorter and wider and less freely movable on the head than that of *Lama*. The two internal ridges are soft, low, and short, and probably little more than functionless vestiges of those present in *Lama*. The basal prominence is tolerably similar to that of *Lama*, but at its upper extremity there is a deep transverse groove cutting off a ridge, the position and structure of which suggest its homology with the supratragus of normal mammals. The posterior extremity of the ridge turns upwards behind the base of the anterior of the two soft ridges above mentioned. (Text-fig. 41, D.)

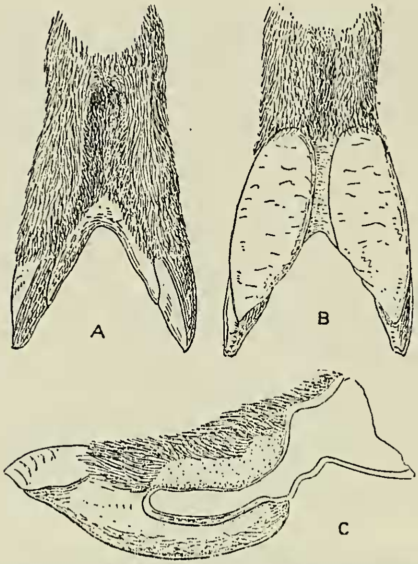
The Feet.

In *Lama* the feet are long and narrow, each of the digits being provided with an elongated cushion-like pad, rounded behind and narrowed in front, where it runs into the small, somewhat nail-like hoof. Distally the digits are capable of being widely separated by a deep cleft between them. Behind this cleft the soles are united, but the extent of their fusion varies to a certain degree. In an example of *L. glama* the fusion was so complete as to obliterate superficially all trace of the line of junction. But in *L. vicugna* there was a tolerably deep, wide, and long groove between them. A similar but shallower and narrower groove separated the heels in an Alpaca; and in this animal the cleft between the digits extended half-way along the soles, whereas in *L. glama* and *L. vicugna* the interdigital cleft was shorter. On the upper side of the foot there is a long, deep, interdigital depression lined with glandular integument, secreting a waxy substance smelling like the urine of *Mus musculus*. In *L. vicugna* and *L. glama* the floor and sides of this depression were naked, but in an Alpaca they were clothed with hair for the most part, only the distal edge of the depression being naked on both fore and hind foot. On the latter the proximal deepest portion, where the skin is most active, was also naked, whereas on the fore foot the corresponding spot was clothed with short radiating hairs. (Text-figs. 42, 43.)

In the Proceedings of this Society for 1916, p. 748, I described and figured the two metatarsal glands of *Lama vicugna*. The

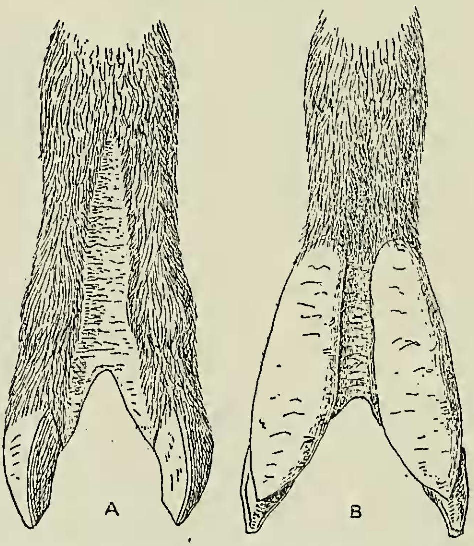
* In the domesticated races, but not in the wild species, the tips of the ears are, typically at all events, curved slightly forwards.

Text-figure 42.



A, B. Upper and lower views of foot of *Lama glama* (Alpaca variety).
C. Section of foot of *Lama glama* (common variety).

Text-figure 43.

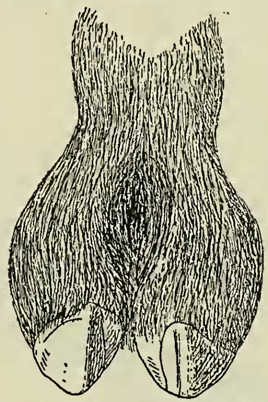


A, B. Upper and lower views of foot of *Lama huanacus*.

naked, depressed glandular area, overlapped by hair, was about four times as long as wide, and gradually narrowed at its distal end. In a male Alpaca the glandular area was more exposed than in the Vicuña, was not depressed but flat, and was only overlapped by hair at the extreme margin above distally. It was also shorter and differently shaped, its length being $1\frac{3}{4}$ inches and its breadth $\frac{3}{4}$ of an inch; the lower border was sinuously convex and the upper had a submedian bulge; its proximal and distal ends were approximately equal in width, the former being $7\frac{1}{4}$ inches from the hock, the latter 5 inches from the fetlock. (Text-fig. 39, A.)

The feet of *Camelus dromedarius* are more specialized than those of *Lama*. The two digits are fused nearly up to the hoofs, so that their under sides form a continuous sole, about as wide as long, with at most a shallow, irregular, median crease to mark

Text-figure 44.



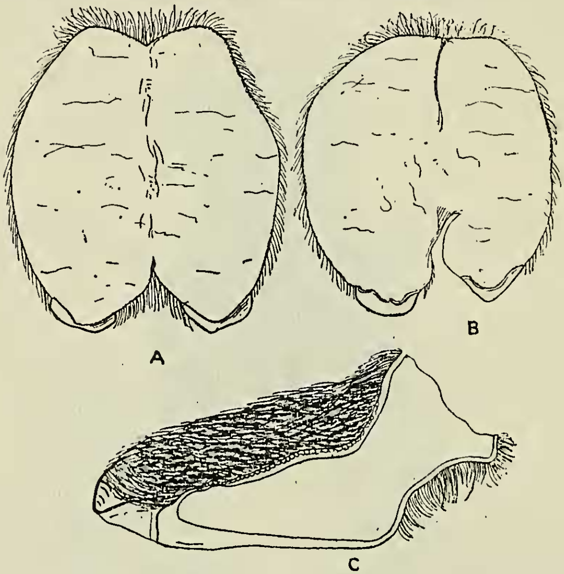
Upper view of foot of *Camelus dromedarius*.

the line of union. At the digital end of the sole there is a tolerably deep angular emargination where the digits are free and diverge from one another. The fore foot is both wider and longer than the hind foot, and in the specimen examined was narrowed posteriorly, the hinder edge of the sole, or heel, showing a shallow angular emargination. In the hind foot, on the contrary, the posterior border of the sole was convexly rounded, and formed a continuous curve with the lateral margins, which, like those of the fore foot, were tolerably evenly but lightly convex. This hind foot was asymmetrical, the inner digit being larger than the outer, and the proximal cleft between them was twisted externally at its deepest part. On the upper side of both fore and hind foot there is a deep, long interdigital depression lined throughout with hair, and glandular, the secretion having a strong odour like the urine of *Mus musculus*. The skin of the sole is not very thick at the heel, but it thickens towards the hoofs, forming a strong junction at this point between the two digits. The inner surface of each digit between this junction and the hoof is naked. (Text-figs. 44, 45.)

The Penis.

Athough the penis in the Camelidæ has been previously described, this organ in the Mammalia generally is so important from the systematic standpoint that I venture to draw attention to the profound differences it exhibits in this family from that of the rest of the Artiodactyla. In the latter the glans is always

Text-figure 45.

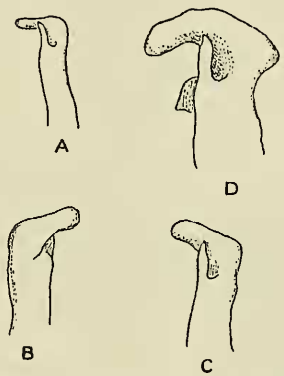


A, B. Lower view of fore and hind foot of *C. dromedarius.*
C. Section of foot of the same.

soft and flexible. Considering its length, it seems remarkable that in no case has an os penis or baculum been developed. In the Camelidæ also there is no baculum, but the tip of the glans instead of being soft is rigid, hard, and apparently cartilaginous. The apex, moreover, is bent sharply to the left, like a stout hook, underlying and apparently acting as a guard to the slender, straight, forwardly directed process, at the tip of which the genito-urinary orifice opens.

In the Alpaca and in *Lama huanacus* the hook is simple and nearly straight. In the latter it is slender, and is bent at right angles to the axis of the glans; whereas in the Alpaca it is stouter, and is bent at an obtuse angle. In *Camelus dromedarius* the hook forms an almost rectangular bend, but is slightly curved and has a lightly convex anterior and a concave posterior edge.

Text-figure 46.



A. Tip of glans penis of *Lama huanacus* from above.
B, C. Lower and upper views of the same of *L. glama* (Alpaca).
D. The same of *Camelus dromedarius* from above.

Externally on the right side it forms a shoulder-like excrescence, defined posteriorly by a deep concavity from the main part of the glans; and on the left side there is a soft projecting lappet on the glans behind and beneath the base of the little process carrying the genito-urinary orifice. (Text-fig. 46.)